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Engineering Leadership

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Academic Leadership Journal

Engineering Leadership

Introduction

Around the 1960 and on to today, the environment of today's is on customer satisfaction. Achieving this new paradigm, Engineering is to be more flexible and adaptable to the demands and expectations of stakeholders.

The top – down traditional hierarchical structure doesn't act properly any longer.

Managing change doesn't mean only controlling it, rather understanding it , adapting to it where necessary and guiding it when possible. (Carter McNamara, 1997)

The history of engineering leadership backs to Cyrus , The Great, Persian king , who combined managerial characteristics with army dexterities to lead the significant kingdom Persia.

Three main issues mentioned by Cyrus : 1- Goal setting , 2- Strategy decision and determine suitable path to achieve and 3- Distribute the results suitably.

(Hedrick,Larry ,2006 , P.17)

Nowadays the emphasis on various principles is observed where the key components of effective engineering leaders is the ability to motivate and equip people by being able to communicate clearly , manage and organize conflicts , develop creativity and technical tasks.

Engineering leaders will be called upon to foresee developing threats to our environment and sustainability, and they will need to bring their messages effectively to political leaders. They will have to understand and cross multidisciplinary boundaries, because solving the most difficult problems will involve multiple, interacting and conflicting causes and effects. Language skills, cultural competency, and other soft skills will be brought into a comprehensive systems analysis of their work .(Barlow , 2008)

Engineering Leadership methods are useful for mid-level managers due to their responsibility between Top managers (Strategy decision making , needs leadership aspects) and Operational managers (Technical proportion is more emphasized) .

In the current information technology century , run an organization needs science and art , the former calling engineering where the latter is linked to leadership.

Much of frustration and dissatisfaction in industry is directly related to the lack of these components attachment.

The mission is to prepare the next generation of technology leaders , although engineering leadership is known as almost a new paradigm , the latest field called Engineering Leadership Network (ELN) is

appeared to face information century issues.

ELN recognizes that in addition to the technical expertise, true technological leadership requires several key abilities to such as critical thinking , emotional intelligence , organize people from multiple disciplines and cultures and the spirit for innovation and entrepreneurship .The emphasis in engineering leadership goes to three fields : System engineering concept , Economic consideration and organizational skills.

Definitions

Engineering Leadership is defined as the technical leadership of the innovative conception, design and implementation of new products / processes / projects/ systems supported by invention of enabling technologies to meet the needs of customer satisfaction as well as the society.

Engineering Leadership: Process of envisioning, Designing, Developing and Supporting new products and services to a set of requirements, within budget and to a schedule with acceptable levels of risk to support the strategic objectives of an organization. (Dr. Wade H. Shaw ,2003,P.5)

Engineering Leadership Requirements

Engineering Leaders exist to develop and sustain products and services using systems engineering principles in project organizations which widely used in nowadays ' complex business environment.

Since HR role is rarely ignored , lead and nurture people involved in the projects need managerial skills beside the technical knowledge related to the problems faced.

Any projects running by an engineering leader should be fully clear in answer to three crucial questions :

1. What is the current situation ?
2. Why does the situation need to be improved ?
3. How does this passing steps to the paced ?

(Dr. Wade H. Shaw 2003,P.7)

Engineering Leaders are people who can create significant change in both followers and organization which they are associated. (Iain Hay , Flinders University)

They should lead change in culture, strategy , structure and informal relations.

They must be equipped with deep knowledge and concentrate on three main fields : Business concepts , Human resources and Learning & Development.

Set strategic business objectives , determine organization capabilities , assess employee leadership and technical competencies are categorized in business concept class.

Human resource includes training , career path development , optimized performance and recruiting high quality workforce .

In learning and development, Continuous learning, increase knowledge, finds progress opportunities and industry – university link will be mentioned.

Finally, Engineering leadership is divided mainly into business leadership focusing on customer satisfaction through updated leading approach and technical leadership mentioning details and specific information on unique subject.

Engineering leadership is categorized in the field of transformational leadership. Transformational leaders elevate people from low level of needs , focusing on survival mentioning Maslow's hierarchy, to higher levels .

(Kelly, M.L., 2006) (Yukl, G.A. 1989).

Such a kind of leaders are said to engender trust , administration , loyalty and respect amongst their followers . (Barbuto, J.E. 2005,pp.26-40.)

Since engineering leadership is known as a new paradigm in management , Transformational leadership principles can be hired for that field.

The four common I 's is mentioned in the following :

1. Idealized influence : Charismatic vision and wholly accepted by followers.
2. Inspirational motivation : Capacity to motivate others achieving the forecasted goals.
3. Intellectual stimulation : Encouraging innovation and creativity among group members.
4. Individualized consideration ;Coaching to the specific needs of followers.

(Hall, J., Johnson, S., Wysocki, A. & Kepner, K. , 2002).

(Simic, I. 1998., pp. 49-55.)

(Southwest Educational Development Laboratory, 2004).

(Leithwood, K. & Jantzi, D. (2000), p. 112.)

Capabilities of Engineering Leaders

The engineering leaders' potential to put up with issues running in the organization is divided into three group which is followed by some details each;

1. The attitudes of leadership: Core personal values and character.

- Initiatives : ability and willingness to take risks.

- Decision making in the face of uncertainty.

- Responsibility , Urgency and will to deliver : commitment to the absolute responsibility to find best alternative due to presence of obstacles or constraints.

- Resourcefulness and flexibility : embrace various views and make best use of different related sources.

- Ethical actions and integrity

- Equity and diversity

- Visions and intention in life for progress

- Self awareness and self-improvement : defining career path

2. Relating : Developing key relationships and networks.

- Inquiring and dialoguing : create constructive dialog

- Negotiation , compromise and conflict solution : find mutually acceptable solutions.

- Advocacy:

- Diverse connections and grouping

- Interpersonal skills : mention both individually and organization needs and objectives.

- Structured communications : be able to create a structure and strategy to formal communications.

3. Making sense of context : Make a mental map of the complex environment.

- Awareness of the societal and natural context

- Awareness of the needs of the customer or beneficiaries

- Enterprise awareness : understanding the goals and culture , shared beliefs and strategies.

- New technology appreciation

- System thinking : thinking holistically to force on critical features.

4. Visioning : Future awareness.

- Thinking creatively

- Defining various solutions

- Technical knowledge and critical reasoning

Many theorists emphasizing on Economic side of leadership mentions three skills including managing people , managing resources and showing technical competence .

(Economics for future leaders , 2009).

Effective Engineer Leaders

People believed leaders are charismatic and they are usually born but nowadays a new paradigm is spread which expresses that leaders are made and leadership skills is not rare traits anymore.

In view of increasing global competition , engineering leadership today should be built on the reinforcement of product engineering education , that is , the education of those who innovate and put product in to production. ” Bernard M.Gordon”

Study case studies of successes , the impact of globalization , failures in running companies ,analyze the problems and potentials in intercultural and interdisciplinary collaboration all prove emergence of effective engineering leaders are crucial.

To be an effective engineering leader , it is important to have developed a deep understanding of the underlying knowledge of engineering , science and technology.

(Massachusetts Institute of Technology)

An effective engineering leader categorizes the elements of competency into three main classes : 1- Knowledge Base emphasizing on science and management fundamentals , 2- Engineering Ability , skillful to formulate , identify the problems , understand culture , environment and global responsibilities and 3- Professional Leadership Attributes including effective communication , individual welfare consideration , intelligence inspiration and ability to function in multi disciplinary and multi cultural teamwork. (Checklist : An initiative of the center for engineering leadership and management, Engineers Australia).

Mentioning basics of engineering leaders , it is clear both organization profitability and individual welfare are important. Besides , ethics is also plays an important role .

“ I was keen to rule a great land , an integrated empire where multi cultural people live in a peaceful manner without involving in tribal fight .”

(Hedrick,Larry, 2006 , P.36)

Leaders should complement their human related skills with engineering principles. Engineering Leaders qualities can be developed and will be continuously refined by more Learning , experience and desire. There are four valuable parameters which is stressed by an effective engineer leader : Needs , Passions , Values and Talents & Skills . The shared proportion by the mentioned factors gives the “Sweet Spot” , the effective engineer leaders mission.

To mention a successful engineering leader , Lee Yakuka as a transformational leader , saved Chrysler Automobile industry. First he understood the employees do not have the suitable challenge for progress in the company.

He spread Friendly leadership principles among workers . Effective workforce is known to be the most productive assets in different countries.



(Salmani , Davoud , 2005 , p.162)

In other words he performed Erosmatic leadership style .Emphasizing on workplace environment and close relation between official staffs and workers in production line , he believed four criterion as survival factors :

- 1.Caring
- 2.Sharing
- 3.Respect
- 4.Responsibility

(Salmani , Davoud ,1997, p.5)

Future Engineer Leaders

What is the view of engineering leadership in the next century ? What are the unique qualities required to lead the organizations of tomorrow ?

The core dilemmas future engineers face are expressed below by 27 most senior executives :

- Broad-based Leadership vs. High-visibility Leaders
- Independence vs. Interdependence
- Long-term vs. Short-term
- Creativity vs. Discipline
- Trust vs. Change s
- Bureaucracy Busting vs. Economies of Scale
- People vs. Productivity
- Leadership vs. Capability
- Revenue Growth vs. Cost Containment

Truly effective engineering leaders in the years ahead will have personas determined by strong values and beliefs in the capacity of individuals to grow .

(Beckhard , Richard, 1996).

They will mention an image of the society in which they would like their organization including core technical details and leadership dexterities.

They believe the future can and should be shaped by both engineers and Leaders.

Engineering leaders won't be rewarded for ordinary tasks and style of running organizations. They are people who can create significant changes in both followers and the organization which they are

associated with.

Due to the competitive variable environment , the primary responsibility for engineering leaders is based on change. In the following years , innovative organizations are to survive in uncertain competitive technological environments .

(Salmani , Davoud ,1997 , p.37)

Four main classes of engineering leaders responsibility are: First , it's necessary to make a compelling case for change. Second , it's important to inspire a shared vision through coaching and conscious role modeling strategies.

Third , change needs to be led. Finally , change need to be embedded by monitoring progress , changing appraisal and reward system and hiring staff with a commitment to collaboration.

Future engineering leaders emphasize on life long foundation for perpetual improvement. Three most important competencies related to future engineering leaders are :

1. Leadership (leadership , strategic direction and entrepreneurship)
2. Management (planning , change and improvement , process , products and services , people / human resources)
3. Business (supplier relationship , information , finance and accounting)

A newer theory to describe engineering leaders express them as artists.

(Pinto , Jim, 2004).

Going through the details of this new theory , it claims there will exist many engineering leaders but a few of them accomplish the strategic goals.

Engineering leaders are expected to satisfy some main issues such as belief in oneself , Passion for the job , Love of people and capacity for aloneness which means mostly leaders are blamed for misfortunes ,so they should be psychologically competent for alteration surveillance.

(Charles Handy , The leader of the future).

Criticism of Engineering Leaderst

The potential situation for engineering leader abuse of power is the most vital issue for criticism since technical knowledge and decision making is inclusive for a unique person. (Stone, A.G., Russell, R.F., & Patterson, K. ,2006).

Respect moral values and limit personal takings should be crucially mentioned in engineering leadership qualification.

Many people call engineering leaders as engineering charisma who confine various techniques and sources.

In history , there existed some leaders abused their power and authority result in destruction and manslaughter so the “dark side of Charisma” should mostly be banned.

Major misunderstanding of engineering leaders will result in organization breakdown. Some are :

- 1- Weak in determining environmental change, technology, competitive advantages and consumer needs.
- 2- Unable in allocating suitable resources and equipment.
- 3- Wrong market evaluation .
- 4- Ignore human side of workforce or lower the priority of human behavior in organization vision.

Some leaders may have narcissistic tendencies , thriving on power and manipulation.

(Yukl, G.A. (1989). &(Bass, B.M. (1997).

Our future engineering leaders must understand the societal impact of their profession , be well – versed in technology and function in global enterprise. They also motivate people and organizations to improve the quality of life around the world.

The aim in reaching Quality of Work life theory is expanding employees motivation by presenting challenging jobs which brings respect and job diversity more.

(Salmani , Davoud , 2005 , p.15)

Looking to the future, it is clear that educating tomorrow’s leaders will become an increasingly prominent part of engineering programs. While there are significant national and cultural differences in how the term ‘leadership’ is understood, the

review points to a deeper consensus about the knowledge and skills that tomorrow’s leaders will require. In recent years, the profile and knowledge-base for the related fields of ‘global engineering education’ and ‘entrepreneurship

engineering education’ have grown considerably, and partnerships across these communities will be an important factor in the future development of excellence in engineering leadership education.

(Graham , Ruth , 2009).

In closing , it can be said that there are some risks associated with engineering leadership.

Engineering leadership must be accompanied by responsibility to ensure the commitment to the good of organization.

Conclusion

The Engineering Leadership is totally may be divided into two important categories : Business Leadership and Technical Leadership .

(Colello, Jerry , Engineering Leadership : Processes and Requirements , United Technologies Corporation , Ohio , USA).

The growing interdependence between technology and economic and social foundations of modern society, there will be an increasing number of opportunities for engineering to exercise their potentials as leaders, not only in business and government sectors but also in the nongovernmental organizations.

To prepare the engineers exploit from opportunities , they must understand the principles of leadership and be able to practice them in growing proportions as their careers advance.

Engineer Leaders as transformational leaders articulate the vision in a clear and appealing manner , explain how to attain the visions , acts confidently and optimistically, express confidence in the followers , emphasize value and ethics with symbolic actions and empower followers to achieve the designed goals.

(Stone, A.G., Russell, R.F., & Patterson, K. , 2006).

To survive in a complex business market including global features of IT – related tasks needs not only techniques but also human issues .Some engineering leaders are necessary to exist that they need to address people issues involving their staffs , business issues and goals , strategies and motivation in the organization. Engineering leaders qualification consists of technical profession and precise insight to lead people , so the followers obey the superior deliberately. These days it is inadequate that Leaders are charisma but they must know the process of parts assembly , system thinking , updated production systems and technical details of a profession.

The key role of engineering leadership is creating economic value and national competitiveness. The emphasis in engineering leadership goes to three fields : System engineering concepts, economic consideration and organizational skills.

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